WATER AND THE ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS.

If we arrange the serial numbers in sections of four each, commencing from the number 2, and then insert in their proper places in the series the atomic weights of the chemical elements, as is done in the following table, we shall find that the elements (taken as whole numbers) which are of less weight than 100, are situated principally in the two inner rows.

These make an arithmetical progression, with 4 as the common difference. Thus, one row contains the numbers 3, 3 + 4, 3 + 8, &c.; and the other row, the numbers 4, 4 + 4, 4 + 8, &c.

This arrangement is somewhat similar to the order observed generally in the arrangement of chemical substances, for the first series suggests an order such as $C\ O_x$, and the other as $C\ O_x\ H$.

Those elements whose atomic weights are contained in the columns 1 and 4, would appear to belong to subsidiary series, and of these there are three, one dependent upon beryllium, if its weight is 9.01, or else upon $H_2\ O$, the second upon sodium, and the third upon zinc. Thus:

9 = 9, Be	23 = 23, Na.	65 = 65, Zn.
9 + 5 = 14, N.	23 + 35.5 = 58.5, Ni.	65 + 5 = 70, Ga.
9 + 10 = 19, F.	23 + 35.5 × 2 = 94. Nb.	65 + 10 = 75, As.
9 + 15 = 24, Mg.		65 + 15 = 80, Br.
		65 + 20 = 85, Rb.
		65 + 25 = 90, Y.

The only number which is not included is 13.6, the atomic weight of Beryllium. Possibly it might be written $9 + \frac{14.01}{3} = 13.67$.

TABLE I.

AN ARITHMETICAL PROGRESSION OF SOME OF THE ELEMENTS IN TWO SERIES, AS $C\ O_x$ AND $C\ O_x\ H$.

1 H.

2	3	4	5
6	Li. 7	8	9
10	B. 11	C. 12	13.6
14	15	O. 16	17
18	F. 19	20	21
22	Na. 23	Mg. 24	25
26	Al. 27	Si. 28	29
30	P. 31	S. 32	33
34	35	36	37
38	K. 39	Ca. 40	41
42	43	44	45
46	47	Ti. 48	49
50	V. 51	Cr. 52	53
54	Mn. 55	Fe. 56	57
58.5	Co. 59	60	61
62	Cu. 63	64	65
66	67	68	69
70	2Cl. 71	72	73
74	As. 75	76	77
78	Se. 79	Br. 80	81
82	83	84	85
86	87	Sr. 88	89
90	91	92	93
94	95	Mo. 96	97
98	99	100	

The difficulty in accepting Prout's hypothesis, that the elements are all formed by the constant addition of unity or hydrogen, lies in the fact that the various elements are not represented in their atomic weights by whole numbers. The explanation which I would suggest is that a gas is a molecule containing two distinct parts—one, a saturated vapour and its mother liquid; and the other part, a surrounding flexible sphere of solid matter of sufficient weight to keep its enclosed vapour at its maximum density at the temperature when the vapour was enclosed.

When, therefore, the spherical shell is increased in weight from 1 to 16, with a corresponding increase of temperature at the time of occlusion, the volume of the vapour is reduced, but it is only in the case of a perfect gas that the volume would become exactly $\frac{1}{16}$ of its former bulk. Hence the relative density of a gas is lessened as its atomic weight increases, and therefore we have the density of oxygen as 15.96, instead of 16, and a double molecule of chlorine weighs 70.74, instead of 71.

In the case of so-called solids the internal water-vapour has become wholly liquid, and therefore the weight of a volume is greater as it contains a greater mass — thus, lithium is 7.01, instead of 7, and potassium 39.02, instead of 39. There is a third case where decrease of volume, unaccompanied by increase of temperature, converts a portion of the vapour within the sphere into liquid. Thus, in the combustion of certain compounds of nitrogen, the amount of heat set free is much below the normal, and this fact is, I think, due to the presence of mother liquid in the composition of the nitrogen element, and its high specific heat — hence the weight of nitrogen is 14.01, instead of 14.

I have in a former pamphlet (called the "Unity of Matter") thrown out the suggestion that water is the only simple element, and that hydrogen is the foundation upon which the other elements are built, because it contains in itself water-vapour at freezing point, and a spherical shell of a weight equal to the pressure due to the tension of steam at that temperature. Thus, the weight of a cubic foot of hydrogen is $\frac{12.37+\frac{1}{9}}{\frac{2}{3}\times 3390}=.0055$ lbs., where 12.37 lbs. is the weight or pressure required to keep a pound of saturated water-vapour at 0° C at its maximum density; $\frac{1}{9}$ is the proportion of hydrogen in the lb. of vapour, and 3390 cubic feet is the volume of a lb. of water-vapour at the temperature of O. C. containing two-thirds of hydrogen. With this hypothesis as a ground-work for the construction of a scheme of atomic weights, I have drawn up in a tentative way the series of combinations of atoms which forms Table II.

The list of those atomic weights which have been accurately determined has been obtained from Professor Humpidge's Appendix to Kolbe's Chemistry, and those atomic weights are here marked with an asterisk *.

TABLE II.

WATER AND ITS ELEMENTAL SUBSTITUTIONS.

1
4.01 } The four parts with weights here given make up nine parts by weight of water, and each
2 } part is capable of removal from the liquid by the substitution of other products.
1.99

ELEMENTS.	THE FOUR SEPARABLE PARTS.				WEIGHT.	ATOMIC WEIGHT.
	1	4.01	2	1.99		
Hydrogen - -	1				1	*1
Lithium - -	1	4.01	2		7.01	*7.01
Nitrogen - -	1 1	4.01 4.01	2	1.99	14.01	*14.01
or by substitution -	1	4.01	Li 7.01	1.99	14.01	*14.01
*Carbon - -			2 2 2	1.99 1.99 1.99	11.97	*11.97
Oxygen - -	C. 11.97		2	1.99	15.96	*15.96
Fluorine - -	1	N. 14.01	2	1.99	19	19
Sodium - -		F. 19	2	1.99	22.99	*22.99
Magnesium - -	1	F. 19	2	1.99	23.99	24
Aluminium - -	1	4.01 4.01	2 N. 14.01	1.99	27.02	*27.02
Silicon - - -	1 1	4.01 4.01	2 N. 14.01	1.99	28.02	28
Phosphorus - -	1	4.01 4.01	2 O. 15.96	1.99 1.99	30.96	*30.96

*In the empty molecular spaces of C., organic compounds of C., O., H., N., are inserted, and in the empty space of O., Mg., S., K., Ca., 2 Fe., &c., are inserted in the formation of other elements.

Elements.	The Four Separable Parts.				Weight.	Atomic Weight.
	1	4.01	2	1.99		
Sulphur - -	C. 11.97	4.01	N. 14.01	1.99	31.98	*31.98
Chlorine - -	1 1	4.01 4.01	2	N. 14.01 $\frac{2N}{3}$ 9.34	35.37	*35.37
Potassium - -	1 1	4.01 Al. 27.02	2 2	1.99	39.02	*39.02
Calcium - -	C. 11.97	Mg. 23.99	2	1.99	39.95	*39.95
Beryllium - -	1 1	4.01 4.01	2 Al. 27.02	1.99	41.03	13.6 × 3
Boron - - -	1 1	4.01 Al. 27.02	2 2	1.99 $\frac{N}{3}$ 4.67	43.69	*10.92 × 4
Titanium - -	C. 11.97	S. 31.98	2	1.99	47.94	48
Vanadium - -	Cl. 35.37	$\frac{Cl}{3}$ 11.79	2	1.99	51.15	*51.1
Chromium - -	1	4.01	Cl. 35.37	$\frac{Cl}{3}$ 11.79	52.17	*52.2
Manganese - -	C. 11.97	K. 39.02	2	1.99	54.98	55
Iron - - -	C. 11.97	Ca. 39.95	2	1.99	55.91	*55.9
Nickel - - -	Cl. 35.37	$\frac{Cl}{3}$ 11.79	2	$\frac{2N}{3}$ 9.34	58.5	58.5
Cobalt - - -	Cl. 35.37	$\frac{Cl}{3}$ 11.79		C. 11.97	59.13	59
Copper - - -	Cl. 35.37	$\frac{Cl}{3}$ 11.79	2	N. 14.01	63.17	*63.18

Elements.	The Four Separable Parts.				Weight.	Atomic Weight.
	1	4.01	2	1.99		
Zinc - - -	Cl. 35.37	$\frac{C}{3}$ 11.79	2	O. 15.96	65.12	65
Gallium - -	$\frac{4}{3}$ Cl. 47.16	$\frac{N}{3}$ 4.67	2	O. 15.96	69.79	69.8
Arsenic - -	$\frac{4Cl}{3}$ 47.16	C. 11.97		O. 15.96	75.09	75
Selenium - -	$\frac{4}{3}$ Cl. 47.16 1	$\frac{N}{3}$ 4.67 4.01	2 2	O. 15.96 1.99	78.79	*78.8
Bromine - -	$\frac{4}{3}$ Cl. 47.16	$\frac{N}{3}$ 4.67	C. 11.97	O. 15.96	79.76	*79.76
Rubidium - -	1 1	4.01 4.01	N. 14.01 N. 14.01	$\frac{4}{3}$Cl. 47.16	85.2	*85.2
Strontium - -	C. 11.97 1	P. 30.96 4.01	2 Cl. 35.37	1.99	87.3	*87.3
Zirconium -	C. 11.97	P. 30.96	Cl. 35.37	$\frac{Cl}{3}$ 11.79	90.09	90.
Yttrium - -	1	Ca. 39.95	$\frac{4}{3}$ Cl. 47.16	1.99	90.1	90
Niobium - -	C. 11.97	4.01	P. 30.96	$\frac{4}{3}$ Cl. 47.16	94.1	94
Molybdenum -	O. 15.96	P. 30.96	2	$\frac{4}{3}$ Cl. 47.16	96.08	96
Ruthenium - -	Mg. 23.99	P. 30.96	2	$\frac{4}{3}$ Cl. 47.16	104.11	104
Rhodium - -	Mg. 23.99	P. 30.96	$\frac{4}{3}$ Cl. 47.16	1.99	104.1	104
Palladium - -	Mg. 23.99	4.01	$\frac{4}{3}$ Cl. 47.16	P. 30.96	106.12	106

Elements.	The Four Separable Parts.				Weight.	Atomic Weight.
	1	4.01	2	1.99		
Silver - - -	1	4.01	2 Cl. 70.74	2 O. 31.92	107.67	*107.67
Cadmium - -	Na. 22.99	4.01	2 Cl. 70.74	N. 14.01	111.75	*111.75
Indium - -	1	Na. 22.99	2 Cl. 70.74	$\frac{4}{3}$ N. 18.68	113.41	*113.4
Tin - - -	1	Na. 22.99	2 Cl. 70.74	$\frac{5}{3}$ N. 23.35	118.08	118
Antimony - -	2 Fe. 111.82	4.01	2	1.99	119.82	*119.8
Iodine - - -	Cu. 63.18	4.01	Mg. 23.99	Cl. 35.37	126.55	*126.55
Tellurium - -	C. 11.97	2 Fe. 111.82	2	1.99	127.78	128
Caesium - -	Fe. 55.91	4.01	2 Cl. 70.74	1.99	132.65	*132.65
Barium - -	1	2 Fe. 111.82	Mg. 23.99		136.81	*136.81
Lanthanum - -	1	Fe. 55.91	$\frac{N2}{3}$ 9.34	1.99 $\frac{2}{Cl}$ 70.74	138.98	139
Cerium - -	1	Fe. 55.91	$\frac{2N}{3}$ 9.34 2	1.99 $\frac{2}{Cl}$ 70.74	140.98	141
Didymium - -	1 1	Fe. 55.91 4.01	$\frac{2N}{3}$ 9.34 2	1.99 $\frac{2}{Cl}$ 70.74	145.99	146
Terbium - -	1	Fe. 55.91 Li. 7.01	$\frac{2N}{3}$ 9.34 2	1.99 $\frac{2}{Cl}$ 70.74	147.99	148
Erbium - -	1	Fe. 55.91	$\frac{2N}{3}$ 9.34 Al. 27.02	1.99 $\frac{2}{Cl}$ 70.74	166	166

Elements.	The Four Separable Parts.				Weight.	Atomic Weight.
	1	4.01	2	1.99		
Ytterbium - -	1 1	Fe. 55.91 P. 30.96	$\frac{2N}{3}$ 9.34 2	1.99 $\frac{2}{Cl}$ 70.74	172.94	173
Tantalum - -	1 1	Fe. 55.91 Ca. 39.95	$\frac{2N}{3}$ 9.34 2	1.99 $\frac{2}{Cl}$ 70.74	181.93	182
Tungsten -	1 1	Fe. 55.91 4.01	$\frac{2N}{3}$ 9.34 Ca. 39.95	1.99 $\frac{2}{Cl}$ 70.74	183.94	184
Iridium - -	4 Cl. 141.48	Na. 22.99	N. 14.01	N. 14.01	192.49	*192.5
Platinum - -	4 Cl. 141.48	Na. 22.99	2	2 N. 28.02	194.49	*194.5
Gold - -	1 1	4.01 4.01	N. 14.01 N. 14.01	$\frac{4}{3}$N. 47.16 $\frac{2}{Fe}$ 111.82	197.02	197
Osmium - -	Fe. 55.91	Fe. 55.91	2	Rb. 85.2	199.02	199
Mercury - -	Fe. 55.91	Fe. 55.91	Fe. 55.91	S. 31.98	199.71	*199.7
Thallium - -	3 Fe. 167.73	Al. 27.02	$\frac{2N}{3}$ 9.34		204.09	204
Lead - - -	3 Fe. 167.73	S. 31.98	$\frac{N}{3}$ 4.67	1.99	206.37	*206.43
Bismuth - -	3 Fe. 167.73	P. 30.96	$\frac{2N}{3}$ 9.34	1.99	210.02	210
Thorium - -	4 Cl. 141.48	Na. 22.99	2 N. 28.02	Ca. 39.95	232.44	232.5
Uranium - -	4 Cl. 141.48	Na. 22.99	Cl. 35.37	Ca. 39.95	239.79	240

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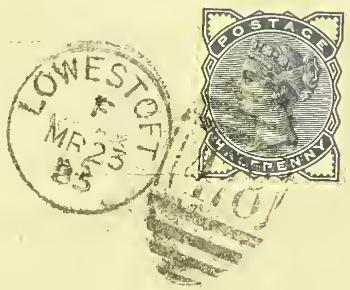

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